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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/509,935

08/19/2005

Serdar Sariciftci

15626-011US1

4312

26161 7590 04/16/2008

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EXAMINER

BERDICHEVSKY, MIRIAM

ART UNIT

PAPER NUMBER

4132

MAIL DATE

DELIVERY MODE

04/16/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/509,935	<b>Applicant(s)</b> SARICIFTCI ET AL.	
	<b>Examiner</b> MIRIAM BERDICHEVSKY	<b>Art Unit</b> 4132	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 01 October 2004 Preliminary Amendment.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/01/2004</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 4 is objected to because of the following informalities: the word “to” is missing from line 1 which it is the Examiner’s opinion should read “The method according to claim 1...”. Appropriate correction is required.
2. Claim 7 is objected to because of the following informalities: It is the Examiner’s opinion that the claim should read “between 4 minutes and 5 minutes”. The claim will be treated as such from herein. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 10-11, 13-15, 19-20, 22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Sentein (as cited in the IDS).

As to claims 10 and 24, the reference teaches a method of treating a photovoltaic cell comprising:

- Heating the photovoltaic cell for a period of time (section 1, ¶ 2), and
- Simultaneously subjecting the photovoltaic cell to an electric field (section 1, ¶ 2) wherein the photovoltaic cell comprises:
  - A first electrode (lower Al electrode, Figure 3),
  - A second electrode (upper Al electrode, Figure 3), and

- A photoactive layer (polymeric film, Figure 3) between the first and second electrodes.

Further regarding claim 19, the reference teaches applying a field voltage to the first and second electrodes and the electric field exceeds a no-load voltage of the photovoltaic cell (section 2, ¶ 3; section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage. .

Further regarding claim 24, the reference teaches simultaneously injecting charge carriers into the photovoltaic cell via at least one electrode selected from the group consisting of the first and second electrode. Application of the field will inherently, inject charge carriers.

Regarding claims 11 and 20, the reference teaches that the photoactive layer comprises an electron donor and an electron acceptor (section 2, ¶1).

Regarding claim 13, the reference teaches that the electric field is formed by applying a field voltage to the first and second electrodes (section 2, ¶ 3).

Regarding claim 14, the reference teaches that the electric field exceeds a no-load voltage of the photovoltaic cell (section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage because the open current voltage of single junction cells are typically of the order of 1 V or less.

Regarding claims 15 and 22, the reference teaches that the electric field exceeds the no-load voltage by at least 1 V (section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cravino in view of Sentein and further in view of Zhao. Applicant is directed to the above paragraphs for a complete discussion of Cravino.

As to claim 1, Cravino teaches a photovoltaic cell comprising,

- A photoactive region and two metal electrodes (p-type/n-type between anode and cathode, Figure 1),
- The photoactive layer comprising a conjugated polymer component and a fullerene component (section 5, ¶ 1), and
- The two metal electrodes provided on either side of the photoactive layer (p-type/n-type between anode and cathode, Figure 1).

Cravino is silent to a method for the post treatment of a photovoltaic cell comprising:

- Subjecting the photovoltaic cell to heat treatment above a glass transition temperature of the conjugated polymer for a predetermined treatment time,
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof.

Sentein teaches a method for the post treatment of a photovoltaic cell comprising:

- Subjecting the photovoltaic cell to heat treatment near a glass transition temperature of the conjugated polymer for a predetermined treatment time (section 1, ¶ 2),
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof (section 1, ¶ 2; section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the fullerene/polymer system of Sentein in Carvino because fullerenes have an extended delocalised  $\pi$ -electron source and lead to the cost effective fabrication of flexible large area solar cells, as taught by Sentein (section 1, ¶ 1).

Neither Cravino nor Sentein teach the heat treatment being above a glass transition temperature of the conjugated polymer.

Zhao teaches a heat treatment being above a glass transition temperature ( $T_g$ ) of the conjugated polymer (Results section, ¶ 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Cravino and Sentein by increasing the heating temperature to above the  $T_g$  of the conjugated polymer as taught by Zhao because a higher crystallization can be obtained at higher crystallization temperatures, as taught by Zhao (Results section, ¶ 4). Higher crystallization as a result of rectification of the polymer molecules reduces potential barriers for extraction of electricity at the electrode, as taught by Sentein (Section 5, ¶ 1). Where increased extraction results from increased electron transport through the cell due to increased cell efficiency.

Regarding claim 2, Sentein teaches that the electric field is induced via a field voltage that exceeds the no-load voltage of the photovoltaic cell by at least 1 V (section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 3, neither Cravino nor Sentein explicitly teach application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980), especially in light of

the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claim 4-9, neither Cravino nor Sentein explicitly teach that the invention as to claim 1 or claim 2 or claim 3 is subjected for between 2 and 8 min (claims 4-6) or between 4 and 5 min (claims 7-9); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 17) or between 4 and 5 minutes (claims 18 and 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6).

8. Claims 12 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sentein as applied to claim 10 above, in view of Zhao. Applicant is directed above for a complete discussion of Sentein.

Regarding claims 12 and 21, Sentein is silent to heating above a glass transition temperature of the electron donor.

Zhao teaches heating above a glass transition temperature of the electron donor (conjugated polymer) (Results section, ¶ 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to increase the heating temperature to above the  $T_g$  of the conjugated polymer



as done by Zhao in Sentein because a higher crystallization can be obtained at higher crystallization temperatures, as taught by Zhao (Results section, ¶ 4).

9. Claims 16-18 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sentein as applied to claim 10 or 19 above.

Regarding claim 16, Sentein suggests application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980), especially in light of the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claims 17-18 and 23, Sentein teaches that the photovoltaic cell is subjected for between 2 and 8 min (claim 17) or between 4 and 5 min (claims 18 and 23); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 17) or between 4 and 5 minutes (claims 18 and 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6).

***Correspondence/ Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MIRIAM BERDICHEVSKY** whose telephone number is (571)270-5256. The examiner can normally be reached on M-Th, 7:30am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571) 272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. B./  
Examiner, Art Unit 4132

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